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ABSTRACT

The first part of the industrial arts curriculum guide provides brief descriptions of the program and course goals for grades K-12 and a one-page chart of program courses. Part 2 contains unit plans for grades 7-12 which provide unit descriptions, credit values, minimum class times, maximum students per class, prerequisites, and various unit objectives, for the following courses: exploratory technology, modern industry and technology, industrial arts, the world of manufacturing, the world of construction, research and development in industrial arts, basic technical drawing, architectural drawing, engineering drawing, specialized drawing, electricity/electronics exploration, and electronics. Part 3 of the guide provides detailed outlines of suggested teaching and learning strategies, basic units of instruction, and evaluation methods for each of the courses listed above. (JR)

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PROGRAM OF STUDIES

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CE001365

FAIRFAX COUNTY PUBLIC SCHOOLS
Department of Instructional Services
Division of Curriculum Services
September 3, 1974

INDUSTRIAL ARTS

GRADES 7 - 12

LETTER OF TRANSMITTAL

Program of Studies defines the instructional program to be implemented in Fairfax County Public Schools. It is to be used by schools in establishing their Commitment to Education as well as a basis for meeting Standards of Quality in Virginia. Schools are encouraged to develop supplemental objectives and program variations in accord with local needs and with the approval of the area superintendent. During the school year 1974-75 the program descriptions and the objectives are subject to intensive review in an attempt to achieve consensus.

The Program of Studies will continue to be developed through the involvement of administrative and instructional personnel, students, parents, and other members of the community. Revision is part of the design of the Program of Studies in order that all persons in the community may participate fully in developing a current, relevant instructional program.

The success of the Program of Studies will depend primarily upon its utilization by teachers and on the continued educational development of our students.

S. John Davis
Division Superintendent

September 3, 1974

INTRODUCTION

The Program of Studies defines the instructional program for Fairfax County Public Schools, kindergarten through grade twelve, and is organized as follows:

Section A - Program Description and General Goals

Section B - Program Objectives

Section C - Suggested Teaching/Learning Strategies

Section D - Prerequisites for Student Placement

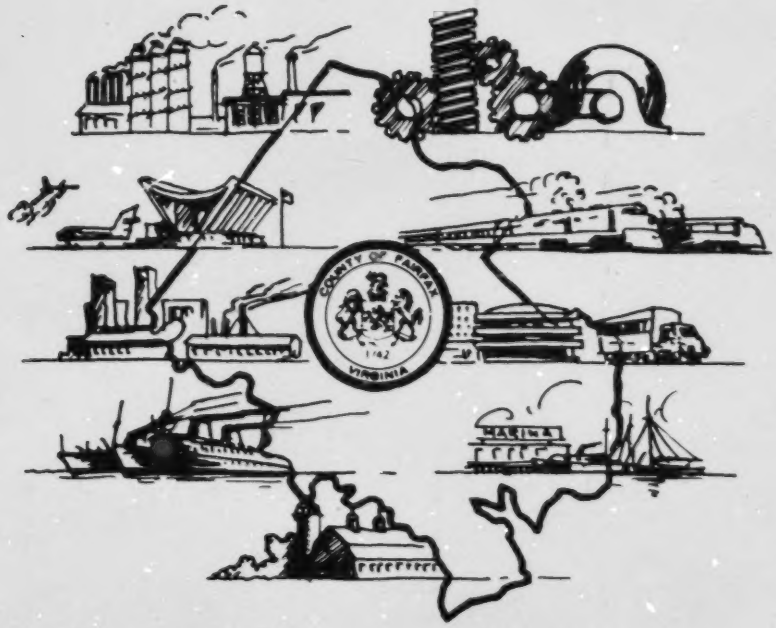
Section E - Program Evaluation

Section F - Instructional Material Requirements

Section G - Program Support Requirements

At present the sections are in various stages of development. During the fall of 1974, instructional personnel will receive for use and reaction Sections A and B, and working drafts for Section C. The other sections will be written, reviewed, and completed at later dates as they are dependent upon Sections A and B.

INDUSTRIAL ARTS



FAIRFAX COUNTY PUBLIC SCHOOLS
Department of Instructional Services
Division of Curriculum Services
September 3, 1974

PROGRAM OF STUDIES

PROGRAM OF STUDIES

INDUSTRIAL ARTS

SECTION A

FAIRFAX COUNTY PUBLIC SCHOOLS
Department of Instructional Services
Division of Curriculum Services
September 3, 1974

PROGRAM OF STUDIES

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PROGRAM DESCRIPTION

Industrial arts is the laboratory-type program designed to prepare students for more effective living in our industrial and technological society. Students develop a positive attitude toward the world of work and recognize their roles in relationship to industry and technology.

The laboratory "hands on" approach in industrial arts provides experiences for students which assist them to discover and develop aptitudes, interests, and needs, and to explore careers. The curriculum focuses on a broad spectrum of industrial technologies which include: (1) career fields (such as transportation, manufacturing, construction, and communications); (2) materials (such as woods, metals, plastics, and ceramics); and (3) processes (such as planning, designing, constructing, organizing, controlling, producing, operating and servicing).

The K-12 industrial arts program emphasizes: career awareness; exploration and orientation through activities such as role playing, field trips, decision making, and problem solving; and use of industry's technical language. Students develop basic technical skills in the use of tools and machines, plan and construct individual and group projects, and engage in learning activities relevant to their future roles and responsibilities as members of an industrial-technical society.

GOALS AND COURSES

K-6

The elementary industrial arts activities are provided to: (1) reinforce learning, (2) enrich learning, (3) motivate students to learn, and (4) increase the desire to learn through "hands on" activities in bridging the concrete world to the abstract. Tools are used in kindergarten classrooms for construction of individual and group projects. Several elementary schools are providing for constructional experiences and career awareness with students scheduled throughout the week in an activities room. Elementary school students should be able to use handtools properly, construct simple projects, discuss and list industrial products, discuss careers, and follow instructions in laboratory-type activities.

7-8

The intermediate school student should be able to recognize and use handtools and machines, express the interrelationships of industry, identify careers, relate his/her talents to industrial needs, develop safe laboratory working habits, and construct simple individual and group projects. At the intermediate level industrial arts courses are elective with one semester in the seventh grade and an option of one or two semesters in the eighth grade.

The courses are:

Course Number	Name
8461	Exploring Technology (grade 7)
8462	Modern Industry and Technology (grade 8)

9-12

Secondary school students should be able to: exhibit manipulative skills with handtools and machines, use materials, express themselves in appropriate industrial terminology, relate sources of raw materials and associated processes, express career desires in terms of personal ability and industrial needs, follow laboratory safety regulations, differentiate among levels of quality of work, read technical drawings and schematics, apply industrial techniques to solve technical problems and improve personal talents related to industry and technology.

Current approved courses are:

Course Number	Name
8405	Industrial Arts I (grade 9-12)
8406	Industrial Arts II (grade 10-12)
8409	Research and Development in Industrial Arts
8431	World of Construction
8425	World of Manufacturing
8435	Technical Drawing
8436	Architectural Drawing
8437	Engineering Drawing
8438	Specialized Drawing (grade 11 or 12)
8702	Electricity/Electronics Exploration
8412	Electricity/Electronics II
8413	Electricity/Electronics III

FAIRFAX COUNTY PUBLIC SCHOOLS
FAIRFAX, VIRGINIA

INDUSTRIAL ARTS PROGRAM

INTERMEDIATE SCHOOLS

7th GRADE (Exploring Technology)
- Wood
- Plastics
- Leather
- Sketching
- Electricity

8th GRADE (Modern Industry & Technology)
- Metal
- Electronics
- Silk Screening
- Drawing
- Two & Four Cycle Engines

SECONDARY SCHOOLS

9th Grade	INDUSTRIAL ARTS I	WORLD OF CONSTRUCTION	WORLD OF MANUFACTURING	ELECTRONICS (9-12)	MECHANICAL DRAWING
10th Grade	INDUSTRIAL ARTS I	WORLD OF CONSTRUCTION	WORLD OF MANUFACTURING	ELECTRONICS II (10-12)	
11th Grade	INDUSTRIAL ARTS II	WORLD OF CONSTRUCTION	WORLD OF MANUFACTURING		ENGINEERING DRAWING / ARCHITECTURAL DRAWING
12th Grade	RESEARCH AND EXPERIMENTATION	WORLD OF CONSTRUCTION	WORLD OF MANUFACTURING	ELECTRONICS III (11-12)	

SPECIALIZED DRAWING

Notes:
1. Industrial Arts I -- begins with 9th grade students
2. Electronics -- begins with 9th grade students
3. Mechanical Drawing -- begins with 9th grade students
4. Industrial Arts II -- for those schools with sufficient demand and space
5. All prerequisites must be honored
6. Any deviation from this program MUST be cleared with the DEPARTMENT OF INSTRUCTIONAL SERVICES

PROGRAM OF STUDIES

INDUSTRIAL ARTS

GRADES 7-12

SECTION B

FAIRFAX COUNTY PUBLIC SCHOOLS
Department of Instructional Services
Division of Curriculum Services
September 3, 1974

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GRADE 7

The Exploring Technology course is a basic historical study of one of three broad areas of technological developments and its contribution to the growth of civilization. Areas of technology offered include: tools and machines, power and energy, and transportation and communications. Students are involved in planning, creating, constructing, and retrieving information pertaining to technology. In addition, projects will be constructed with the following: wood, leather, plastics, and electrical materials.

Credit Value: 1/2
Minimum Class Time: 90 hours
Maximum Students per Class: 25
Prerequisite: None

OBJECTIVES

The student will:

1. Sketch an orthographic and pictorial drawing using the alphabet of lines and proper dimensioning.
2. Measure and lay out materials for projects.
3. Demonstrate safe work habits.
4. Identify and classify the different types of materials and their physical characteristics and uses.
5. Identify and use hand tools and machines.
6. Design, sketch, and construct model and projects.
7. List and describe various manufacturing processes.
8. Calculate the cost of materials used in models and projects.
9. Outline the development of a technology and its contributions to society.
10. Apply good research and reporting techniques.
11. Categorize career opportunities in the technology studied.
12. Present research findings and explain model to the class.

Modern Industry and Technology (8461)
Section B
September 3, 1974

GRADE 8

The course activities are structured upon the individual, group, and line-production projects. Role playing in many career areas is explored--personnel director, product designer, safety engineer, production manager, plant manager, etc. Opportunities are provided for students to apply the organization of industry, materials, tools and machines, processes and products and to become involved in problems of industry. Areas of technology content consist of mechanical drawing, metalworking, electricity/electronics, power mechanics and silk-screening.

Credit Value: 1/2 per semester
Minimum Class Time: 90 or 180 hours
Maximum Students per Class: 25
Prerequisite: None

OBJECTIVES

The student will:

1. Use instruments to produce an orthographic and pictorial drawing applying the alphabet of lines and proper dimensioning.
2. Demonstrate safe work habits.
3. Classify various types of metals and their physical characteristics.
4. Prepare a project plan sheet which will include a plan of procedures, bill of materials, and drawing.
5. Measure and lay out materials for the construction of projects.
6. Identify and use hand tools and machines.
7. Design and construct individual, group, and line-production projects.
8. List and describe various manufacturing and material processes.
9. Perform in a line-production process and related career areas.
10. Employ research and reporting techniques.
11. List various career opportunities in industry.
12. Demonstrate an understanding of basic electrical circuits.

13. Present occupational/career information to the class.

*14. Service and maintain 2-cycle and 4-cycle gasoline engines.

15. Organize, plan and produce a group project that represents an industry.

*16. Perform a variety of home maintenance activities.

* Two-semester program

Industrial Arts I (8405)
Section B
September 3, 1974

GRADES 9-10

Industrial Arts I is a laboratory-type program designed for students to develop basic industrial-technical skills and acquire career orientation and exploration. Instruction in the use of tools, machines, materials and the organization and problems of industry will give the student exploratory industrial experiences. The course provides for the development of a broad range of competencies in industrial technologies for a base of career adaptability.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: None

OBJECTIVES

The student will:

1. Employ good product design principles.
2. Design, sketch, and interpret orthographic drawings in the process of project construction.
3. Use industrial-technical terminology.
4. Use tools and equipment in a safe and approved manner.
5. List characteristics of industrial-technical materials.
6. Recognize quality construction in industrial products.
7. Demonstrate by example how to conserve natural resources.
8. Participate in career-orientation activities.
9. Relate technological innovations to changes in contemporary society.
10. Perform with basic proficiency in the following industrial processes: measuring, layout, sawing, shearing, drilling, turning, forming, casting, abrading, fastening, and finishing.
11. Describe systems for converting power and energy to do work.
12. Apply appropriate technological principles in the communication field.
13. Perform within a simulated personnel system of a mass-production-type industry.

Industrial Arts II (8406)
Section B
September 3, 1974

GRADES 10-12

The areas offered in Industrial Arts I are also offered in this course, but the nature of the problems and operations increases in complexity. It provides for extended development of basic industrial-technical skills. In addition the student will investigate selected aspects of product design and development. Students will work in one or more technological areas of interest.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: Industrial Arts I

OBJECTIVES

The student will:

1. Prepare a plan of procedure, working drawings, and a bill of material for all products constructed.
2. Design and construct projects to an advanced degree of proficiency.
3. Describe career opportunities and educational requirements in several technical areas.
4. Recognize the relationship of multi-materials in various industrial products.
5. Use tools and machines competently in the application of industrial processes.
6. Compare physical and chemical characteristics of industrial-technical materials.
7. Explain technological advances used in contemporary industrial processes.
8. Perform work in a safe and approved manner.
9. Design and perform within a simulated personnel system of industry.

The World of Manufacturing (8425)
Section B
September 3, 1974

GRADES 9-12

The World of Manufacturing is a comprehensive course in manufacturing technology. The course is divided into three major sections: a brief history of manufacturing, an analysis of management-personnel-production system, and a synthesis of manufacturing practices applied to the corporation.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: None

OBJECTIVES

The student will:

1. Recognize manufacturing technology in the broad context of industrial technology.
2. Explain the development of the manufacturing phase of industry.
3. Utilize management practices such as planning, organizing, and controlling as they relate to manufacturing production systems.
4. Simulate personnel practices: hiring, training, working, advancing, retiring, and negotiating.
5. Perform production practices in preprocessing, processing, and postprocessing as they apply to manufacturing systems.
6. Simulate the interrelationship between management, personnel, and production practices in the manufacturing industries.
7. Identify manufacturing processes, tools, machines, and materials.
8. Evaluate career opportunities in manufacturing industries.
9. Work in a safe and approved manner.

GRADES 9-12

The World of Construction is a comprehensive course in construction technology. The course is composed of three major units: an analysis of the management-personnel-production systems, a synthesis of house construction systems, and regional construction planning practices.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: None

OBJECTIVES

The student will:

1. Recognize construction technology in the broad context of industrial technology.
2. Incorporate management practices such as planning, organizing, and controlling in construction systems.
3. Simulate personnel practices as related to labor/management organization.
4. Employ production practices in preprocessing, processing and postprocessing or servicing as they apply to construction technology.
5. Use tools and materials of the construction industry.
6. Indicate the interrelationship of construction technology and community development.
7. Assess career opportunities in the construction industry.
8. Interpret the significance of construction technology in the past, present, and future.
9. Work in a safe and approved manner.
10. Discuss local construction codes and zoning regulations.

Research and Development in
Industrial Arts (8409)
Section B
September 3, 1974

GRADES 10-12

Students use a variety of industrial tools, equipment, and materials to test and evaluate products, processes, and materials through the application of scientific principles and procedures. The course provides the opportunity for students to select a problem or area of interest to him/her which can be solved or developed through the experimental process. Special equipment necessary for the experiment may be supplied as part of the lab facilities or developed by the students. Conclusions will be reached by the students as a result of tabulating data from the experiment.

Credit Value: 1
Minimum Class Time: 180 hours
Maximum Students per Class: 16
Prerequisite: None (recommended scientific interest background)

OBJECTIVES

The student will:

1. Apply the scientific approach to the solution of a variety of problems.
2. Compare and contrast industrial research with practical engineering.
3. Identify tools, processes and materials used in industry.
4. Design activities which produce an end result previously determined.
5. Summarize career opportunities in the area of industrial research.
6. Analyze a problem and synthesize possible solutions based on experimental observation.
7. Evaluate consumer goods in terms of their capability to perform specified functions.
8. Demonstrate creativity through the design of specialized testing equipment.
9. Present data, results, and conclusions to others both in writing and verbally.
10. Moderate seminar sessions of peer groups.

11. Construct testing apparatus necessary to investigate stated hypothesis/es.

12. Develop an experimental approach based on research into periodicals, journals, and other related resource areas.

13. Classify and record data from experimental activities.

Basic Technical Drawing (8435)
Section B
September 3, 1974

GRADES 9-12

Basic Technical Drawing is an exploratory course designed to help students learn fundamentals of technical drawing. Students will develop basic skills in drawing and gain an understanding of technical processes.

Credit Value: 1
Minimum Class Time: 180 hours
Maximum Students per Class: 30
Prerequisite: None

OBJECTIVES

The student will:

1. Acquire skill in the use of 13 drawing instruments essential to the production of technical drawings.
2. Produce drawings using orthographic standards.
3. Apply three special techniques to an orthographic drawing.
4. Employ 22 ASA (American Standards Association) drawing standards when indicating the size of objects.
5. Demonstrate understanding of methods used in describing objects pictorially.
6. Use principles of geometric construction in the production of drawings.
7. Recognize the importance of drawing as a communication device in a technical society.
8. Identify careers and be aware of opportunities in the field of technical drawing.
9. Differentiate among basic industrial processes, such as foundry, forging, welding, and machining.
10. Relate the application of basic industrial processes through drawings.
11. Apply problem-solving techniques when related to technical drawing.
12. Demonstrate the concept of conservation in the use of supplies and drafting equipment.

*13. Work cooperatively in small groups to solve drawing problems.

*14. Distinguish among Military, SAE (Society of Automotive Engineers) and ASA standards as they apply to machine drawing.

*15. Produce a drawing in one or more of the following special areas: architectural, topographical, electricity-electronics.

* Optional

Architectural Drawing (8437)
Section B
September 3, 1974

GRADES 10-12

This course is designed to assist the student in developing basic knowledge and skill in the field of architectural drawing. The student will learn various construction methods, plan a house, and develop working sketches, drawings, and a scale model. This is an exploratory experience for the careers in architecture.

Credit Value: 1
Minimum Class Time: 180 hours
Maximum Students per Class: 30
Prerequisite: Basic Technical Drawing

OBJECTIVES

The student will:

1. Use industrial equipment and techniques for producing architectural drawings.
2. Produce drawings using architectural rules and procedures.
3. Outline careers in an architect's office and in the building industry.
4. Relate building processes and materials to a single-family dwelling.
5. Design a single-family dwelling.
6. Prepare drawings which completely describe a house.
7. Recognize local laws and ordinances as they apply to single-family dwellings.
8. List four major influences on architectural styles.
9. Describe environmental factors having ecological implications when designing climate-control systems.

*10. Design a small commercial building.

*11. Prepare a complete set of plans for a commercial building.

*12. Relate light construction processes and materials to a commercial building.

*13. Be familiar with local laws and ordinances as they apply to commercial buildings.

*14. Construct a model of the dwelling that he/she designed.

* Optional

Engineering Drawing (8436)
Section B
September 3, 1974

GRADES 10-12

The course is designed to help students gain a working knowledge of the specialized phases of technical drawing careers as they are used in modern industry. It provides experiences of greater depth in engineering drafting problems, skills and techniques. Emphasis is placed on ability to use handbooks of standards and specifications with other resource material.

Credit Value: 1
Minimum Class Time: 180 hours
Maximum Students per Class: 30
Prerequisite: Mechanical Drawing I

OBJECTIVES

The student will:

1. Use industrial techniques and equipment in the production of drawings.
2. Apply industrial methods of size-control.
3. Employ appropriate rules and procedures for the production of engineering drawings.
4. Use industrial measuring and testing devices to gather data.
5. Demonstrate through drawings the application of instrumentation and testing devices.
6. Organize and perform the duties of various careers within a drawing department.
7. Apply problem-solving techniques to product design.
8. Be aware of industrial finishing processes.

*9. Develop a set of drawings for a designed product.

*10. List methods of fastening metals, woods and plastics.

* Optional

GRADES 11-12

Specialized Drawing is designed to give the individual student an opportunity to advance in one or more selected fields of technical drawing. The individual's specific program is developed in cooperation with the teacher. He/she is encouraged to work independently with general supervision rather than from detailed instruction.

Credit Value: 1
Minimum Class Time: 180 hours
Maximum Students per Class: 20
Prerequisite: Successful completion of Basic Technical Drawing (8435), and Engineering Drawing (8436) or Architectural Drawing (8437)

OBJECTIVES

The student will:

1. Use industrial equipment and techniques for producing specialized drawings.
2. Produce specialized drawings using advanced rules and procedures.
3. Outline careers in specific trade clusters, such as transportation, communication, construction, and manufacturing.
4. Apply processes and materials to related specialized fields.
5. Plan, organize and complete a culminating activity based on study in a specialized field.

*6. Design a building with a maximum of six floors.

*7. Design a tool post to hold a cutting bit on the machine lathe.

*8. Demonstrate the use of folding planes in descriptive geometry.

*9. List 20 symbols used in electricity-electronics schematics.

*10. List the elements and fundamentals of design.

*11. Explain the basic principles of hydraulic lifts.

*12. Design a simple jack using fluid dynamics.

*13. Explain the processes in developing a transition piece.

*14. List ten plumbing symbols.

*15. Draw a single-family dwelling with plumbing fixtures.

*16. Prepare a working drawing of a small aircraft or motorcycle.

*17. List six welding symbols.

* Optional

Electricity/Electronics
Exploration (8702)
Section B
September 3, 1974

GRADES 9-12

The main purpose of this course is to introduce electricity and electronics to the students through the study of job descriptions, consumer information, fundamentals of electrical and electronic theory and applications, and trouble-shooting of components and simple circuits. The course is exploratory rather than skill oriented.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: None

OBJECTIVES

The student will:

1. Recognize and use typical electric and electronic measuring and test equipment correctly and safely.

2. Recognize and utilize the various electrical and electronic components that are used in the industry.

3. Identify several electronic systems by block diagrams, i.e., AM radio, FM radio, black and white TV, color TV and the digital computer.

4. List careers in the electrical and electronics fields and identify these careers by job analysis.

5. Discuss sources of consumer information for the purposes of buying quality electric and electronic devices economically.

6. Exercise proper safety techniques while working in an environment that includes electrical and/or electronic equipment and circuits.

7. Explain the meaning of certain electrical fundamentals including:
   a. basic electrical circuits
   b. magnetism and electromagnetism
   c. alternating current
   d. reactive circuits and resonance
   e. filter networks

8. Construct several circuits normally required in wiring a family dwelling.

9. Construct and analyze electronic circuits utilizing vacuum tubes and solid state devices including amplifier, rectifier and oscillatot circuits.

10. Explain the fundamentals of transmission and reception of radio signals.

11. Perform adjustments on AM radios, FM radios, black and white television sets, and color television sets.

12. Demonstrate basic trouble-shooting techniques on electric and electronic components, circuits and systems.

13. Recognize several industrial and military systems including:
    a. security controls
    b. medical devices
    c. telemetry systems
    d. detection and identification devices

14. Distinguish among types of computers such as digital, analog, or hybrid.

Electronics II (8412)
Section B
September 3, 1974

GRADES 10-12

The course is exploratory in nature. Theory and circuitry are dealt with beginning with the termination of Pre-Technical Electricity/ Electronics I. Trouble-shooting extends into more complex circuits and systems now. Job descriptions and consumer information continue to be a part of the program at this level.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: Electricity/Electronics Exploration

OBJECTIVES

The student will:

1. Analyze A/C circuits using "complex numbers."
2. Identify and contrast various filter circuits.
3. Differentiate among various types of transformers.
4. Identify and utilize various rectifiers including solid state and tube types.
5. Construct and compare several solid state and tube rectifier circuits used such as power supplies, including half-wave, full-wave, bridge, and voltage doubler.
6. Construct and analyze single-ended output solid state and vacuum tube amplifiers.
7. Construct and analyze vacuum tube and transistor oscillators.
8. Explain radio transmission and reception.
9. Describe AM and FM radio operation with functional block diagrams and schematics.
10. Align and trouble-shoot AM and FM radios.
11. Describe the operation of black and white and color television receivers using functional block diagrams.
12. Service black and white and color television sets by making simple adjustments and minor repairs.

13. Construct amplifiers using integrated circuits.

14. Construct and analyze circuits utilizing individual components and integrated circuits.

15. Describe computer operation from a functional block diagram.

16. Research an electronic circuit or system; construct this as a project and explain its operation.

17. Describe security-control, telemetry and medical systems by block diagram.

Electronics III (8413)
Section B
September 3, 1974

GRADES 10-12

More in-depth electronic theory is studied in this course and trouble-shooting extends into more complex electronic systems. Research and experimentation are encouraged more at this level than in the previous electronics courses, in order to broaden the students' scope of electronics careers.

Credit Value: 1
Minimum Class Time: 180 days
Maximum Students per Class: 24
Prerequisite: Electronics II

OBJECTIVES

The student will:

1. Compare and use certain types of rectifying devices including conventional rectifiers, zener diodes, tunnel diodes, and silicon controlled rectifiers.
2. Construct and analyze power supplies including the bridge rectifier supply, the zener diode supply, and the voltage doubler.
3. Construct and analyze vacuum tube and transistor amplifiers including the push-pull output type.
4. Distinguish among several types of active oscillators.
5. Describe radio and TV broadcast systems.
6. Distinguish between cathode ray tubes with deflection plates and deflection coils.
7. Diagnose and repair black and white television troubles using recommended service manuals and equipment.
8. Make adjustments on color television sets using recommended procedures as described in service manuals.
9. Employ integrated circuits in amplifier, oscillator, and logic applications.
10. Use research and experimentation to broaden the scope of information and to apply fundamentals already learned.
11. Construct security and control systems.
12. Describe schematically, telemetry and medical electronic systems.

PROGRAM OF STUDIES

INDUSTRIAL ARTS

GRADES 7-12

SECTION C

WORKING DRAFT

FAIRFAX COUNTY PUBLIC SCHOOLS
Department of Instructional Services
Division of Curriculum Services
September 3, 1974

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I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definitions
a. Individual projects--each student makes a decision as to the project he/she wants to plan, organize, construct, and materials to use for construction of a project
b. Unit--each student selects an area (sub-topic) that is a part of or related to the unit topic chosen by the class (the water turbine is an example of a sub-topic under the unit topic dealing with power and energy). The students are involved in three areas of activity--tools and machines, power and energy, and transportation and communication. They are engaged in the pursuit of information, project construction, and the sharing of information through the group seminar
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Resource people
e. Field trips
f. Instructional sheet
g. Written report
h. Seminar

B. Organizational Alternatives
1. Setting
a. General industrial arts laboratory
b. A library for student research
2. Personnel
a. Certified in industrial arts
b. Collegiate preparation, through in-service or pre-service in the Maryland Plan workshop

II. Basic Units

A. Sketching
1. Describes the uses of technical drawing
2. Uses the alphabet of lines in sketching
3. Develops an orthographic drawing
4. Develops an isometric drawing
5. Demonstrates proper dimensioning practice
6. Develops a set of working drawings
7. Prepares a plan sheet for the construction of a project

B. Anthropological/Contemporary Technology
1. Identifies and properly uses
a. Measurement and layout tools
b. Hand and machine saws

c. Drilling and boring tools and machines
d. Hand and machine planning devices
e. Turning tools
f. Shaping tools
g. Fasteners and fastening devices
h. Abrasive tools and materials
i. Finishes and finishing

2. Demonstrates safe work habits
3. Traces the history of the development of one of the technologies studied
4. Describes forest products
5. Identifies the characteristics of common woods
6. Lists the steps in the production of lumber
7. Calculates the costs of materials used in projects

C. Individual Student Project

1. Lists career opportunities in the wood, plastics, and leather industries
2. Lists the classifications of pelts
3. Explains tanning methods
4. Describes the leather industries
5. Identifies basic leather tools
6. Carves and tools leather
7. Fastens leather
8. Finishes leather
9. Traces the history of the plastics industry
10. Lists advantages and disadvantages of plastics
11. Classifies plastics
12. List manufacturing processes used in the plastics industry
13. Laminates plastics
14. Lists manufacturing processes used in the wood industry

III. Evaluation

A. Testing

1. Teacher-made tests
2. Evaluation of individual work

B. Grading

1. A through F grading scale
2. Pass-fail grading system

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definitions
a. Individual projects-- ach student makes a decision as to the project he/sh wants to plan, organize, construct, and materials to use for construction of a project
b. Line production--high volume production industries are studied through an actual line production experience. The class organizes a company with a management and labor structured based. Management and labor role-playing is necessary for the class to succeed at producing and marketing a product
c. Group project--the class selects an industry for an in-depth study. The students organize, plan and produce a single product that represents the chosen industry. Role-playing in many career areas is explored
2. Techniques
a. Demonstrations
b. Lectures
c. Audio visual aids
d. Role-playing
e. Group discussion
f. Field trips
g. Use of resource people
h. Information sheets

B. Organizational Alternatives
1. Setting
a. General laboratory with adequate storage space for materials and projects
b. Industrial visits
2. Personnel
a. Certified in industrial arts and have collegiate preparation through American Industries Project and/or the Maryland Plan, in-service or pre-service, to implement Modern Industry and Technology
b. Resource people as guest speakers

II. Basic Units

A. Communication
1. Classifies communication devices: mechanical, graphics and electrical
2. Traces the history of technical drawing
3. States the types of technical drawings
4. Uses the alphabet of lines
5. Uses drawing instruments
6. Develops an orthographic projection

7. Develops a pictorial drawing
8. Uses proper dimensioning practice
9. Develops a set of working drawings
10. Prepares a plan of procedure for construction of a project
11. Defines the terms
    a. Voltage
    b. Amperage
    c. Resistance
    d. Wattage
12. Uses electronic test and measurement devices
13. Explains AC and DC current flow
14. Experiments with electrical circuits
15. Lists the printing processes
16. Produces a hand screen print
17. Works with tools and machines in a safe manner

B. Career Information
1. States how to find and apply for a job
2. Describes an employment contract
3. Describes sales and sub-contracts
4. Describes mediations, arbitrations, and strikes
5. Cooperates with others to complete a task

C. Materials Technology
1. Traces the history of metals
2. Describes methods of ore extraction
3. Describes ore refinement
4. Classifies and states the characteristics of common metals
5. Describes how iron is converted into steel
6. Describes the advantages and methods of metal plating
7. Identifies types of sheet metal
8. Identifies and uses standard metal stock
9. Describes how metal is turned
10. Identifies the uses and procedures for heat treating
11. Describes the metal processes of rolling, stamping, forging, casting, extruding and drawing
12. Identifies and properly uses
    a. Measurement, layout and marking tools
    b. Cutting and sawing tools and machines
    c. Drilling and boring tools and machines
    d. Shaping techniques
    e. Turning tools and machines
    f. Molding techniques as applied to metals and casting
    g. Grinding techniques
    h. Heat fastening techniques as applied to metals
    i. Forging techniques
    j. Mechanical and adhesive fasteners and devices
    k. Finishes and finishing procedures
13. Performs all work in a safe manner

D. Production
1. Traces the evolution of mass production
2. Describes the function of patents

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3. Describes the function of stock certificates
4. Designs and/or presents to the class a possible production product
5. Identifies and participates in management and labor roles
6. Describes the use of jigs, fixtures, and conveyors
7. Interprets the need for quality control
8. Examines the role of finance and marketing in production

E. Transportation
1. Describes the development of transportation and its effect on society
2. Lists and identifies types of engines and transmissions
3. Describes the uses of hydraulics and pneumatics
4. Disassembles and assembles an electric motor and a small gasoline engine
5. Uses hand and machine tools in a safe manner

F. Group Project
1. Traces the evolution of a class selected project area
2. Identifies and participates in management and labor roles
3. Helps in constructing a project module
4. Participates in staff meetings and special purpose meetings

III. Evaluation

A. Testing
1. Written or oral tests at various stages
2. The teacher will evaluate the group project
3. The teacher will evaluate individual work

B. Grading
1. A-F
2. Pass-fail

Industrial Arts I (8405)
Section C
September 3, 1974

I. Strategies for Teaching and Learning

A. Industrial Approaches
1. Definition
a. Individual projects--each student makes decisions as to the projects he/she wants to plan, organize, construct, and materials to use for construction of a project
b. Servicing exercises--students practice in various servicing techniques on their own products and laboratory tools and equipment
2. Techniques
a. Demonstrations
b. Lectures
c. Audio visual aids
d. Field trips
e. Use of resource people
f. Use of reference manuals and texts

B. Organizational Alternatives
1. Setting
Fully equipped general industrial arts laboratory
2. Personnel
Certified industrial arts instructor qualified in multiple activities
3. Time
a. One hour five days per week
b. Two hours three days per week
c. Two hours two days per week

II. Basic Units

A. Drawing
1. Sketches working drawings
2. Designs and sketches a project

B. Materials Processing
1. Recognizes the difference and uses of woods, metals, plastics and ceramics
2. Uses tools and machines to process materials
3. Shows basic proficiency in all industrial processing required to construct projects

C. Servicing
1. Services a transportation vehicle
2. Services a small electrical appliance
3. Maintains tools and machines
4. Sharpens cutting tools

D. Communications
1. Performs simple electronic communication experiments
2. Produces a silk screen project

E. Power and Energy
1. Performs experiments on circuits commonly used in wiring a single family dwelling
2. Discusses converting power and energy to do work

III. Evaluation

A. Testing
   1. Teacher made unit tests
   2. Teacher evaluation of projects

B. Grading
   1. A-F
   2. Pass-fail

Industrial Arts II (8406)
Section C
September 3, 1974

I. Strategies for Teaching and Learning

A. Industrial Approaches
1. Definition
a. Individual projects--students make decisions as to the projects he/she wants to plan, organize, construct, and materials to use for construction of projects
b. Servicing exercise--students service vehicles, equipment, and appliances to gain servicing skills
c. Skill development exercises--students perform various exercises leading to proficiency of a salable skill
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Field trips
e. Use of resource people
f. Use of reference manuals and texts
g. Use of job analysis charts
h. Use of servicing job sheets

B. Organizational Alternatives
1. Setting
Fully equipped general industrial arts laboratory
2. Personnel
Certified industrial arts instructor qualified in multiple activities
3. Time
a. One hour five days per week
b. Two hours three days per week
c. Two hours two days per week
4. Teaching options
a. Single teacher, instruction
b. Team teachers, instruction

II. Basic Units

A. Drawing
Design and sketch a project

B. Materials Processing
1. Recognizes the difference and uses of woods, metals, plastics and ceramics
2. Uses tools and machines to process materials
3. Shows basic proficiency in all industrial processing required to construct projects

C. Servicing
1. Diagnoses, troubleshoots, and repairs household appliances and internal combustion engines
2. Sharpens and repairs a variety of hand tools and industrial equipment
3. Provides minor maintenance and adjustments to industrial machines

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D. Communications
   1. Constructs an electronic communication device
   2. Produces a silk screen project
E. Power and Energy
   1. Performs the wiring commonly used in a single family dwelling
   2. Discusses converting power and energy to do work

III. Evaluation

A. Testing
   1. Unit written tests
   2. Teacher evaluation of projects
B. Grading
   1. A-F
   2. Pass-fail

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definition
Mass production--products are manufactured in quantity by students participating as a structured company
2. Techniques
a. Demonstrations
b. Lectures
c. Audio visual aids
d. Role-playing
e. Group discussion
f. Field trips
g. Use of resource people
h. Use of lab manual and text
i. Information sheets

B. Organizational Alternatives
1. Setting
Fully equipped general industrial arts laboratory
2. Personnel
a. Certified in industrial arts
b. Collegiate preparation through in-service or pre-service in the World of Manufacturing workshop
3. Time
a. One hour, five days per week
b. Two hours, three days per week
c. Two hours, two days per week

II. Basic Units

A. Personnel in Manufacturing
1. Hiring and training
2. Working, advancing, and retiring
3. Organization of labor and collective bargaining

B. Design and Engineering the Product
1. Developing working drawings
2. Building the prototype

C. Manufacturing Production
1. Converting raw materials to industrial materials
2. Making materials in standard stock
3. Planning production processes
4. Establishing production and quality control
5. Making and combining components and assemblies

D. Distribution and Sales

III. Evaluation

A. Testing
1. Written tests at various stages
2. Line production by class as corporation evaluated by teacher

B. Grading
   1. A-F
   2. Pass-fail

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definitions
Group projects--work is usually done in groups of five students with each student completing a portion of each assignment leading to a completed construction project
2. Techniques
a. Demonstrations
b. Lectures
c. Audio visual aids
d. Role-playing
e. Field trips
f. Information sheets
g. Lab manual and text
h. Resource people

B. Organizational Alternatives
1. Setting
a. General industrial arts laboratory with adequate storage space for materials and projects
b. Outside area for surveying, and for block and brick work
c. Visits construction sites
d. Technical media center, which includes construction resources
2. Personnel
a. Certified industrial arts instructor with collegiate preparation through in-service in the World of Construction workshop
b. Qualified resource people in various construction trades as guest demonstrators
3. Time
a. One hour per day five days per week
b. Two hours per day alternating three and two days per week

II. Basic Units

A. Personnel in Construction
1. Describes the organization of a construction company and the duties of a contractor
2. Role plays the relationship between unions and management
3. Participates in the hiring process for a construction project
4. Lists occupational training

B. Design and Engineering
1. Uses the design and engineering to
a. Identify design problem
b. Refine ideas
c. Analyze designs
d. Select a design

2. Uses design specification

C. Construction - Production Technology
   1. Lists the steps involved in the combining, forming and separating of materials in construction
   2. Classifies structure into substructure and superstructure

D. Superstructure
   1. Examines the construction of dams, bridges, highways, and skyscrapers
   2. Simulates construction of a high-rise building

E. House Construction
   1. Site preparation
      a. Describes the method of clearing a site
      b. Surveys a building site
      c. Describes foundation stabilization
   2. Substructure
      a. Sets a foundation
      b. Fabricates foundation forms
      c. Mixes, pours, and finishes concrete
   3. Utilities
      a. Identifies utility networks
      b. Installs climate control, plumbing, and electrical systems
   4. Superstructure
      a. Constructs a roof
      b. Encloses exterior walls
      c. Installs heat and insulation on ducts and pipes
      d. Encloses interior walls
      e. Installs ceiling and floor tile
   5. Finishing
      a. Applies paint
      b. Installs hardware accessories
      c. Finishes site
      d. Services property

F. City and Regional Planning
   1. Identifies reasons and methods of high density housing
   2. Describes the economics and management of community development
   3. Designs and constructs a model community

III. Evaluation

A. Testing
   1. The package includes written tests at various stages
   2. The teacher will evaluate the group projects
   3. The teacher will evaluate individual work

B. Grading
   1. A-F
   2. Pass-fail

Research and Development in
Industrial Arts (8409)
Section C
September 3, 1974

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definition
Individual approach--each student selects a problem and designs an experimental program to analyze the problem based on the scientific method
2. Techniques
a. Seminar sessions
b. Resource persons
c. Field trips
d. Audio visual resources
e. Student research
f. Written report

B. Organizational Alternatives
1. Setting
a. General industrial arts laboratory
b. Full access to library
2. Personnel--qualified industrial arts teacher
3. Hours
a. One hour per day, five days a week
b. Two hours per day every other day

II. Basic Units

A. Problem Design
1. Reviews available data on problem
2. Selects specific hypothesis/es
3. Designs approach to test hypothesis

B. Research and Seminars
1. Takes notes on library material
2. Interviews persons knowledgeable of subject
3. Writes report on progress
4. Presents current data at seminar
5. Moderates one or more seminars
6. Prepares agenda for seminar

C. Problem Solving
1. Designs testing devices relative to problem
2. Constructs testing device
3. Conducts test or exercise
4. Records data
5. Forms conclusion
6. Prepares paper containing all pertinent information

III. Evaluation

A. Diagnostic Technique
1. Questionnaire
2. Interview

B. Testing
   1. Paper-pencil
      a. Teacher-made
      b. Student-made
   2. Oral
   3. Result of construction phase
   4. Teacher and student evaluation of presentations
   5. Teacher evaluation of written reports

C. Grading
   1. A-F
   2. Pass-fail

Basic Technical Drawing (8435)
Section C
September 3, 1974

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definition
Individual assignment--each student works independently on assigned tasks
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Field trips
e. Resource people
f. Instructional sheet
g. Text
h. Resources and references

B. Organizational Alternatives
1. Setting
a. Fully equipped industrial arts drawing laboratory
b. Access to general industrial arts laboratory
2. Personnel
a. Certified industrial arts teacher
b. Qualified industrial resource personnel
3. Hours
a. One hour per day, five days per week
b. Two hours per day, alternating three and two day weeks

II. Basic Units

A. Lettering
1. Develops letters by single-stroke method
2. Applies letter spacing techniques

B. Sketching
1. Sketches alphabet of lines
2. Estimates lengths and proportion for sketching

C. Instruments
1. Uses T-square and triangle
2. Reads and interprets architect's scale
3. Uses compasses, erasing shield and templates properly

D. Geometry
1. Divides lines equally
2. Bisects angles
3. Constructs polygons
4. Draws circles, arcs, and tangencies

E. Multiview Drawing
1. Selects and places views
2. Draws center and hidden lines
3. Projects lines, points, and surfaces

F. Dimensioning
1. Uses size and location dimensions
2. Applies proper dimensions to a problem
3. Identifies reference, decimal dimensioning, and tolerancing

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G. Shop Processes
   1. Observes forming, casting and machining methods
   2. Identifies nomenclature and terms
H. Sectional Views
   1. Draws full, half, offset, and assembly sections
   2. Describes revolved, removed, and broken out sections
I. Auxiliary Views
   1. Develops left, right, front, rear, and partial auxiliary views
   2. Plots the true size of an inclined surface
J. Revolutions
   1. Develops revolutions about axes perpendicular to front, top, and side planes
   2. Draws true length of line
K. Pictorial Drawings
   1. Draws isometric
   2. Draws oblique
   3. Draws perspective
L. Working Drawings
   1. Draws a set of working drawings of a single object
   2. Describes the evolution of a product from conception to the point of production
M. Developments
   1. Draws parallel line development
   2. Draws radial line development
N. Reproduction Processes
   1. Identifies mechanical and photochemical reproduction processes
   2. Identifies special reproduction processes

III. Evaluation

A. Diagnostic Technique
   1. Pre-test
   2. Questionnaire
   3. Interview
B. Testing
   1. Paper-pencil
      a. Teacher-made
      b. Standardized
   2. Oral
   3. Demonstration
   4. Teacher evaluation of student assignments
C. Grading
   1. A-F
   2. Pass-fail

Architectural Drawing (8437)
Section C
September 3, 1974

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Individual assignment--each student works independently on assigned tasks
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Field trips
e. Resource people
f. Instructional sheet
g. Text, supplements and codes
h. Resources and references

B. Organizational
1. Setting
a. Fully equipped industrial arts drawing laboratory
b. Access to general industrial arts laboratory
2. Personnel
a. Certified industrial arts teacher
b. Qualified industrial resource personnel
3. Hours
a. One hour per day, five days per week
b. Two hours per day, alternating three and two day week

II. Basic Units

A. History
1. Identifies European, Early American and present styles of residential houses
2. Predicts future styles of houses

B. Architectural Drafting Techniques
1. Identifies architectural drawing instruments and templates
2. Uses architectural lettering and symbols

C. Planning the House Environment
1. Identifies survey and site plans
2. Applies local ordinances and building codes
3. Describes location of public conveniences
4. Integrates house designs and landscape

D. Preliminary Plans
1. Draws three basic areas of a house
2. Describes placement and styles of kitchen and bathroom
3. Integrates traffic patterns in floor plans
4. Plans closets and duct areas in the floor plan
5. Identifies roof styles
6. Develops cost analysis for housing
7. Sketches floor plans, elevations and perspectives

E. Overall Planning
1. Aligns beaming partition, drains and stair structure
2. Designs cornice, shutters and entrance to the house

F. Floor Plans
   1. Designs and draws floor plans for a house
   2. Prepares notes, dimensions and title block for a house plan
   3. Prepares window, door and finish schedule
   4. Applies lettering and symbols to a house plan

G. Elevations
   1. Designs and draws elevations for a house
   2. Applies lettering and symbols to a house plan
   3. Designs door and windows for a house plan

H. Substructures
   1. Identifies foundation members and materials
   2. Letters and dimensions foundation plans
   3. Draws foundation plan to scale

I. Plot Plans
   1. Draws plot plan to scale
   2. Dimension and letters plot plan

J. Plumbing and Electrical Plan
   1. Identifies types of plumbing and electrical fixtures
   2. Applies symbols and lettering

K. Climate Control
   1. Describes heating and cooling systems
   2. Identifies filtering and dehumidifing devices
   3. Sketches an air conditioning plan

L. Specification Writing
   1. Write specifications for one area of the construction process

M. Construction Details
   1. Describes types, styles, and material of a wall section, stair, windows and doors
   2. Draws a stair, wall section, windows and doors and framing plans to scale
   3. Applies building codes to construction details

III. Evaluation

A. Diagnostic Technique
   1. Pre-test
   2. Questionnaire
   3. Interview

B. Testing
   1. Paper-pencil
      a. Teacher-made
      b. Standardized
   2. Oral
   3. Demonstration
   4. Teacher evaluation of student assignments

C. Grading
   1. A-F
   2. Pass-fail

Engineering Drawing (8436)
Section C
September 3, 1974

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definition
a. Individual assignment--each student works independently on assigned tasks
b. Group task--work is done in groups of five or more to complete some assignments
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Field trips
e. Resource people
f. Instructional sheets
g. Text
h. Resources and references

B. Organizational Alternatives
1. Setting
a. Fully equipped industrial arts drawing laboratory
b. Access to general industrial arts laboratory
2. Personnel
a. Certified industrial arts teacher
b. Qualified industrial resource personnel
3. Hours
a. One hour per day five days per week
b. Two hours per day, alternating three and two day weeks

II. Basic Units

A. Topographic Drawing, Mapping and Surveying
1. Reads, traces, and inks maps
2. Develops plot surveys including contour lines
3. Uses a simple transit level, and identifies parts
4. Translates field notes

B. Threads, Fasteners and Springs
1. Draws simplified, schematic, and detailed thread drawings
2. Draws semi-conventional sharp, V, unified and American standard threads
3. Draws hexagonal and square bolts and nuts
4. Draws rivets, springs and identifies other types of fasteners

C. Dimensioning (Precision)
1. Uses the metric system
2. Uses ordinate and tabular dimensioning
3. Applies dimensions for fit, finished surfaces, and position

D. Shop Processes
1. Uses industrial measuring devices
2. Describes jigs, fixtures, and heat treating

3. Describes techniques used in hardness testing
4. Prepares finish notes

E. Intersections and Developments
1. Lays out patterns for a three section elbow, gutter, and transition piece
2. Lays out intersection of two square prisms, and two right cylinders
3. Lays out intersection of prism and cylinder, and intersection of cone and cylinder

F. Charts and Graphs
1. Develops line, bar, and pie chart
2. Develops a pictograph

G. Drafting Room Practices
1. Develops and utilizes personnel system
2. Describes the use of revisions and standard parts on drawings

H. Cams and Gears
1. Identifies types, kinds and uses of cams
2. Lays out motion of plate or disc cam
3. Identifies types, kinds, and uses of gears
4. Uses formulas for drawing a gear tooth

I. Structural Drawing
1. Lays out wood, iron and steel, and concrete structures
2. Describes the classification of structural drawing

J. Research and Design
1. Applies elements and fundamentals of design to two and three dimensional problems
2. Applies scientific method of investigation to problems
3. Designs commercial product

K. Schematic Drawing
1. Reviews the fields in which schematic drawings can be made
2. Draws schematic

L. Working Drawings
1. Develops layout design of detail and sub-assembly drawings
2. Draws assembly pictorial and develops parts list

III. Evaluation

A. Diagnostic Technique
1. Pre-test
2. Questionnaire
3. Interview

B. Testing
1. Paper
   a. Teacher-made
   b. Standardized
2. Oral
3. Demonstration
4. Teacher evaluation of student assignments

Engineering Drawing (8436)
Section C
September 3, 1974

C. Grading
   1. A-F
   2. Pass-fail

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definition
Individual assignments--each student works independently on assigned tasks
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Field trips
e. Resource people
f. Instructional sheet
g. Texts
h. Resources and references

B. Organizational Alternatives
1. Setting
a. Fully equipped industrial arts drawing laboratory
b. Access to general industrial arts laboratory
2. Personnel
a. Certified industrial arts teacher
b. Qualified industrial resource personnel
3. Hours
a. One hour per day, five days per week
b. Two hours per day, alternating three and two day weeks

II. Basic Units

A. Aeronautical/Aerospace
B. Commercial Architecture
C. Computer Programming and Flow Process
D. Descriptive Geometry
E. Design
F. Electricity and Electronics
G. Fluid Dynamics
H. Graphs, Charts, and Mathematics
I. Naval Architecture
J. Patent Drawing
K. Plumbing
L. Sheet Metal
M. Structural
N. Tool Design
O. Topographical
P. Welding
Q. Blueprint Reading
R. Lettering
S. Advanced Engineering

III. Evaluation

A. Diagnostic Technique
   1. Pre-test
   2. Questionnaire
   3. Interview

B. Testing
   1. Paper-pencil
      a. Teacher-made
      b. Standardized
   2. Oral
   3. Demonstration
   4. Teacher evaluation of student assignments

C. Grading
   1. A-F
   2. Pass-fail

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Class procedure is generally as follows
a. Teacher-class discussion of circuits
b. Teacher demonstration of circuits to be tested in the laboratory
c. Laboratory experiments
d. Summary of experiments
e. Quizzes
2. Other instructional approaches include
a. Job sheets and laboratory manuals
b. Films, filmstrips, transparencies and wall charts
c. Speakers from industry
d. Field trips
e. Self-study, such as, research and experimentation, extra laboratory experiments and project construction

B. Organizational
1. Setting - Modern, fully equipped electronics laboratory
2. Personnel - One qualified electronics instructor. A student laboratory assistant is optional
3. Hours
a. One hour per day, five days per week
b. Two hours per day, alternating on a three-day and two-day week

II. Basic Units

A. Introduction
1. Identifies electrical and electronic test equipment by sight
2. Recognizes electrical and electronic components
3. Recognizes electronic systems as illustrated in block diagram form
4. Describes careers in the electricity and electronics fields
5. Utilizes consumer information in selecting electronic equipment for personal use

B. Safety
1. Exercises proper safety techniques while working in an environment that includes electrical and/or electronic equipment and circuits
2. Demonstrates an awareness of the value of laboratory equipment and handles such equipment with due care

C. Electrical Fundamentals
1. Measures and computes the parameters of direct current electrical circuits including simple, series, parallel and combination types
2. Describes the generation of alternating current
3. Describes the action of reactive components in AC circuits
4. Differentiates between active and passive components and circuits

D. Housewiring
   1. Wires typical lighting circuits required in a family dwelling
   2. Abides by national and local electric codes
   3. Computes the ampacity for a typical dwelling

E. Vacuum Tube and Solid State Fundamentals
   1. Describes solid state and vacuum tube diodes and their applications
   2. Uses transistors and vacuum tubes in amplifier and oscillator circuits constructed on breadboard
   3. Performs minor trouble-shooting procedures on breadboarded circuits
   4. Describes solid state devices that have been developed recently

F. Receiver Introduction
   1. Describes the operation of radio and television by means of functional block diagrams
   2. Identifies components in the schematic diagram of a radio receiver
   3. Performs minor adjustments and trouble-shooting procedures on radios and television sets

G. Industrial and Military Systems
   1. Describes security and control systems by means of block diagrams
   2. Lists electronic medical systems in use
   3. Tells what electronic monitoring telemetry systems do
   4. Describes a basic computer system by functional block diagram

H. Research and Experimentation
   1. Researches an electrical or electronic device in order to describe its operation
   2. Constructs, demonstrates and describes the function of the device

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definitions
a. Individual assignment--each student works independently on assigned tasks
b. Skill development exercises--students perform various activities leading to proficiency of a salable skill
c. Group projects--two or more students designing, planning, researching and constructing a project
2. Techniques
a. Lecture
b. Demonstration
c. Audio visual aids
d. Field trips
e. Use of resource people
f. Use of reference manuals and texts
g. Use of job analysis charts
h. Use of servicing job sheets

B. Organizational Alternatives
1. Setting
Fully equipped electronics laboratory
2. Personnel
Certified industrial arts instructor qualified in electronics
3. Time
a. One hour five days per week
b. Two hours three days per week
c. Two hours two days per week
4. Teaching options
a. Single teacher, instruction
b. Team teachers, instruction

II. Basic Units

A. Alternating current circuits with reactance
1. Solves A/C circuit problems using "complex numbers"
2. Identifies and contrasts types of filter circuits
3. Differentiates between types of transformers

B. Rectifiers
1. Recognizes types of rectifiers including solid state and tube
2. Constructs and compares solid state and tube rectifier power supplies

C. Amplifiers
1. Constructs and analyzes single-ended output solid state amplifiers
2. Constructs and analyzes single-ended output vacuum tube amplifiers

D. Oscillators
   Constructs and analyzes a vacuum tube or a transistor oscillator

E. Radio
   1. Explains radio transmission and reception
   2. Describes AM and FM radios with schematics
   3. Aligns AM and FM radios
   4. Troubleshoots AM and FM radios

F. Television
   1. Describes the operation of black and white and color television receivers using functional block diagrams
   2. Services black and white and color television sets by making adjustments and minor repairs

G. Integrated Circuits
   1. Constructs amplifiers using integrated circuits
   2. Constructs and analyzes circuits utilizing individual components and integrated circuits

H. Industrial and Military Systems
   1. Describes computer operation from a functional block diagram
   2. Describes security-control, telemetry and medical systems by block diagrams

I. Research and Experimentation
   1. Researches an electronic circuit or system
   2. Constructs an electronic circuit or system and explains its operation

I. Strategies for Teaching and Learning

A. Instructional Approaches
1. Definitions
a. Individual project--each student identifies an electronics problem and designs an experimental program to analyze the problem based on the scientific-method
b. Skill development exercises--students perform various activities to develop competencies with electronics theory, experiments and systems
2. Techniques
a. Lecture
b. Demonstration
c. Field trips
d. Use of reference manuals and texts
e. Use of job analysis charts
f. Use of servicing job sheets

B. Organizational Alternatives
1. Setting
Fully equipped electronics laboratory
2. Personnel
Certified industrial arts instructor qualified in electronics
3. Time
a. One hour five days per week
b. Two hours three days per week
c. Two hours two days per week
4. Teaching options
a. Single teacher, instruction
b. Team teachers, instruction

II. Basic Units

A. Power Supplies
1. Constructs and analyzes the following:
a. Bridge rectifier
b. Zener diode
c. Voltage doubler
2. Determines applications of types of power supplies
3. Designs a power supply

B. Amplifiers
1. Constructs and analyzes vacuum tube and transistor amplifiers including the push-pull type
2. Explains the operation of a stereo amplifier
3. Designs an amplifier

C. Oscillators
1. Distinguishes among several types of oscillators
2. States applications of oscillator types

D. Radio and Television
   1. Describes component functions of AM and FM radios
   2. Describes radio and television broadcast systems
   3. Distinguishes between cathode ray tubes with deflection plates and deflection coils
   4. Diagnoses and repairs black and white television sets
   5. Makes adjustments on color television sets

E. Solid State Devices
   1. Recognizes and states the function of the following solid state devices:
      a. Zener diodes
      b. Silicon controlled rectifiers
      c. Field effect transistors
      d. Tunnel diodes
   2. Tests available solid state devices

F. Integrated Circuits
   Employs integrated circuits in amplifier, oscillator and logic circuits

G. Industrial and Military Systems
   1. Constructs diode logic circuits
   2. Constructs security and control systems
   3. Describes telemetry and medical electronic systems schematically

H. Research and Experimentation
   1. Writes a paper on an electronic system
   2. Constructs and demonstrates an electronic circuit or system and explains its operation

III. Evaluation

A. Diagnostic Techniques
   1. Questionnaire
   2. Pre-test
   3. Interview

B. Testing
   1. Written tests including:
      a. Objective type
      b. Essay type
   2. Laboratory performance tests

C. Evaluation of Laboratory Activities including:
   1. Experiments
   2. Troubleshooting
   3. Projects
      a. Construction techniques
      b. Student demonstrations
      c. Ability to function
      d. Originality of design